DOCUMENT RESUME

ED 081 224 EM 011 402

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TITLE The Role of a Computer Science Department in the Use of the Computer in Undergraduate Curricula at a Small Liberal Arts College.
INSTITUTION Clarke Coll., Dubuque, Iowa.
PUB DATE Jun 73
NOTE 6p.; Paper presented at the Conference on Computers in the Undergraduate Curricula (Claremont, California, June 18-20, 1973)

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS College Libraries; Computer Assisted Instruction; *Computer Oriented Programs; Computers; *Computer Science Education; *Curriculum Development; Higher Education; *Interdisciplinary Approach; Networks; State of the Art Reviews; *Undergraduate Study

ABSTRACT

There are several ways in which the computer science department at the small liberal arts college can contribute to the richness of the institution's undergraduate curriculum. In addition to providing training for students interested in computer-related careers, the department, by offering courses for non-majors in the field, can broaden the perspective of the student by informing him about the computer, its functions, and its social significance. Another function of the department is to integrate the computer into other disciplines so that these fields may use it for information storage and retrieval, simulation, and computation. Computer-assisted instructional programs and user-oriented program libraries are two other services which the computer science staff can provide. Finally, the department can serve as the focal point around which a critical mass of computer oriented people from other disciplines can meet to develop interdisciplinary programs. To accomplish all this, the small college will most likely have to join a computer network in order to be able to afford the advantages of large machines. (PB)

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THE ROLE OF A COMPUTER SCIENCE DEPARTMENT IN THE USE OF THE COMPUTER IN UNDERGRADUATE CURRICULA AT A SMALL LIBERAL ARTS COLLEGE

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In 1965, when we inaugurated the computer sciences department at Clarke College (a small, midwestern liberal arts college for women) we set two main objectives for the department:

1. To develop a curriculum in the computer sciences which would provide professional training for students who wished to pursue computer-related careers either immediately after completing their first degree or after graduate work in the field.
2. To provide facilities and programming support for all faculty and students for both research and instruction in any field.

To begin with, I would like to point out that, at least in our experience the two objectives turned out to be interrelated. First of all, the presence of a computer science department and the availability of a computer science program attracted students who had an interest in the field and who also wanted to attend a small liberal arts college. In turn, these students generated interest in the use of a computer in other classes and for other students. Secondly, the existence of the department required trained personnel. This provided the campus with the expertise needed to make efficient and more sophisticated use of a computer.

We named the use of a computer as an instructional tool "computer-extended instruction", and throughout the past eight years have explored varying ways of extending undergraduate instruction with its help. We will discuss some of this experience.

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2. The Role of the Computer Science Department

Recall that we have a number of students that are interested in the computer from a career standpoint and hence were enrolled in computer courses from the day they arrived at college. This is a key point in much that follows. Also, it should be pointed out that there is no independent major in the computer sciences offered at this institution. Those who wish a major must make computer sciences a joint major with another field. It can be combined with any field for which the student can make the adjustments. For example, we currently have a student who combined computer science with Spanish, another with music, several with sociology and psychology. More numerous are those who plan an economics or mathematics combination. In a sense, then, we have "infiltrated" a variety of fields with serious students of computer sciences. In addition, more than a fifth of the entering freshmen take an introductory course in their first semester, and probably half of the student body completes one course before graduation. We think the freshman year is the best time for an introduction, especially from the standpoint of making a decision to take more work along this line, as well as making use of what is learned in subsequent courses from other fields.

It is our experience that the student most likely to make advantageous use of the computer is one who has had a formal course. All of us can cite cases of a student who did spectacular things with a computer with no formal instruction, and mass indoctrinization in the joys and sorrows of programming through short, non-credit courses can produce a genius or two. But what we are considering here is a planned effort to provide instruction which

will be effective for the majority of students. This, I believe, is an important and perhaps the first function of a computer science department in any liberal arts college. Every citizen has a right and need for correctly presented information about computer systems with their present status and future possibilities. The best source of this information for a liberally educated person in our colleges today ought to be the department which professes the discipline. We have designed our first course and some of the subsequent ones with this aspect in mind.

Formal courses, however, do not necessarily assure an integrated use of the computer in curricula, nor the extention of instruction. The computer science department can make a significant contribution in a number of ways other than the supporting of its own programs. One important means, which is very feasible in smaller institutions and for which provision could be made in larger ones, is that of team teaching. A member of the computer science department becomes a co-instructor for a course. His duties are to help develop programs and procedures to extend instruction in that course. Frequently, one or more knowledgeable students are involved. We have done this at Clarke, especially in the psychology department. The instructor in another field has no need to be an expert in the computer sciences, and is saved from the possibility of being a poor amateur. Of course, it works both ways. The instructor in computer science is saved from some bad assumptions about the teaching of psychology. The team approach is interdisciplinary, and as such is a good example of the integration of knowledge for the student.

4. The Role of the Computer Science Department

The simple technique of keeping a note book, a sort of diary, of how the computer is used as the course progresses, with carefully documented programs, creates material for the next time around, and becomes the basis for improvement which is always needed. From these notebooks good user manuals develop. After some experience, sufficiently well-developed procedures can be established to permit the computer scientist to withdraw, at least until expansion is needed. In our case it happens after about three repeats. There are many courses and many fields. The computer science instructors will not run out of collaborators in any foreseeable future.

At present we have a very large design which has only begun to be realized which we have found most effective in improving the use of the computer for everyone. This is the design of a program library that is user oriented. The computer staff, assisted by students has helped to develop programs for class use. As we have pointed out, these are carefully documented along with comments on their use. In addition to our own work we take time to collect the works of others and adapt and test it. Nothing is given to others for use that has not had test runs, and further some careful consideration of the method of using it in a course, i.e., when, why, and what possible extension to the instruction. We encourage the reporting of any failure, real or user induced. The latter can encourage better documentation. But the design we have in mind, and partly started is the development of all this material in a form to be placed in some

part of the library, similar to audiovisual materials, supervised perhaps by a computer student, and open for browing and borrowing.

We have referred frequently to computer-extended instruction. This broad term may mean different things to different people. We have chosen to define it in terms of effect, that is, we have asked ourselves the question in what ways could, would or should a computer affect learning in general. The answers are as broad as the subject, but some specific ones which come from our experience are as follows. Undergraduate courses can become more research-oriented. A better appreciation of statistical methods becomes available, especially for the non-mathematician, or non-statistican. Graphical and tabular presentation of data is easier, and thus more likely to be used, and more meaningful. The techniques of simulation, only beginning to be explored in the average classroom, can be employed more readily as a means of learning and exploring concepts in a dynamic way. The technique itself is worth knowing about. Concepts of large files of data about anything stored in a fashion that makes retrieval rapid and which can be reduced to useful information can be discussed, used, and have certain myths removed. All of these extensions require expertise which can come from a dedicated computer science department.

The last point I would like to make about the role of the computer science department is in a way an opposite but not incompatible approach to our previous ones. So far, we have discussed an extroverted computer

staff reaching out into the whole of liberal education through courses, team teaching, libraries, and hybrid career development. The last aspect concerns a flow inward. We are setting up a group of faculty members to enhance our instructional programs as well as theirs. We have invited a linguist, a chemist, a psychologist, an economist and a sociologist, with our sights on a few more, to form what we are calling a center for computer-extended studies (what else). All of these people are presently faculty members who are teaching and who have some experience with the computer. We hope that these persons will join us in research on the integration of the computer in their curricula and advise and improve our own horizons. Further, we expect that they will help our career students create better interfaces with many practical fields in business, industry, scientific research, government, or any where that the computer goes. The final role of the computer sciences department can be one of becoming a focal point for those educators who desire greater interdisciplinary instruction without dilution of the discipline or the destruction of the specialist.

In this paper I have not approached the subject of hardware since it was not directly relevant to it, but I do not want to close without one word at least. Small colleges with big ideas still need the machine. The most economical way to get large power is through a network. We have been happy with a small in-house computer remotely connected to a large computer. Future developments in hardware may change this picture, but in any event the people network that the present has created will hopefully grow. This collaboration of computer science departments across a nation is a tremendous model for others.